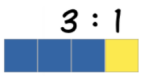
Ratios

A ratio **compares values.**

A ratio says how much of one thing there is compared to another thing.



There are 3 blue squares to 1 yellow square

Ratios can be shown in different ways:

Using the ":" to separate the values: 3 : 1

Instead of the ":" we can use the word "to": 3 to 1

Example: There are 5 pups, 2 are boys, and 3 are girls

Part-to-Part:

The ratio of boys to girls is 2:3 or $^2/_3$

The ratio of girls to boys is 3:2 or $^3/_2$

Part-to-Whole:

The ratio of boys to **all** pups is 2:5 or $^2/_5$

The ratio of girls to **all** pups is 3:5 or $^3/_5$

Example: what is $12 as a percent of $80 ?

Fill in what we know:

$$\frac{\$12}{\$80} = \frac{\text{Percent}}{100}$$

Multiply across the known corners, then divide by the third number. This time the known corners are top left and bottom right:

Percent = ($12 × 100) / $80 = 1200 / 80 = **15%**

Answer: $12 is **15%** of $80

Using Ratios

The trick with ratios is to always multiply or divide the numbers **by the same value.**

Example:

4 : 5 is the same as **4**×2 **: 5**×2 = **8 : 10**

Recipes

Example: A Recipe for pancakes uses 3 cups of flour and 2 cups of milk.

So the ratio of flour to milk is **3 : 2**

To make pancakes for a LOT of people we might need 4 times the quantity, so we multiply the numbers by 4:

3×4 **: 2**×4 = **12 : 8**

In other words, 12 cups of flour and 8 cups of milk.

The ratio is still the same, so the pancakes should be just as yummy.

Example: Rope

A ropes **length** and **weight** are in proportion.

When **20m** of rope weighs **1kg**, then:

- **40m** of that rope weighs **2kg**
- **200m** of that rope weighs **10kg**
- etc.

So:

$$\frac{20}{1} = \frac{40}{2}$$

Scaling

We can use ratios to scale drawings up or down (by multiplying or dividing).

The height to width ratio of the Indian Flag is **2:3**

So for every **2** (inches, meters, whatever) of height there should be **3** of width.

If we made the flag 20 inches high, it should be 30 inches wide.

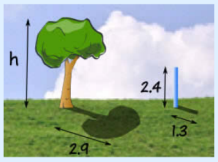
If we made the flag 40 cm high, it should be 60 cm wide (which is still in the ratio 2:3)

Example: How tall is the Tree?

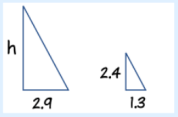
Sam tried using a ladder, tape measure, ropes and various other things, but still couldn't work out how tall the tree was.

But then Sam has a clever idea ... similar triangles!

Sam measures a stick and its shadow (in meters), and also the shadow of the tree, and this is what he gets:



Now Sam makes a sketch of the triangles, and writes down the "Height to Length" ratio for both triangles:



Height ⇒ $\frac{h}{2.9\text{ m}} = \frac{2.4\text{ m}}{1.3\text{ m}}$ ⇐ Shadow Length

Multiply across the known corners, then divide by the third number:

h = (2.9 × 2.4) / 1.3 = 6.96 / 1.3 = **5.4 m** (to nearest 0.1)

Answer: the tree is 5.4 m tall.

Put additional class notes here!

Key Points

A ratio is like a fraction: $\frac{3}{4}$

A proportion is two ratios set equal to each other: $\frac{2}{3}=\frac{x}{6}$

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To solve for an unknown in a proportion, just isolate the unkown: $\frac{2(6)}{3}=x$

$\frac{3}{5}=\frac{x+4}{7}$

For something to be **similar** the ratio of its component parts (sides of a polygon, for example) must be equal. So for two pentagons to be similar, the ratio of their sides must be the same for corresponding sides.

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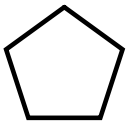
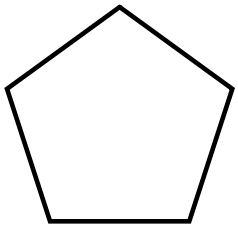


side = 4



side = 10

The ratio is 4/10 or 2/5. Since these are *regular* pentagons, all sides have the same ratio. These are *similar* pentagons.

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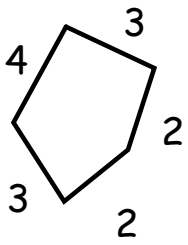
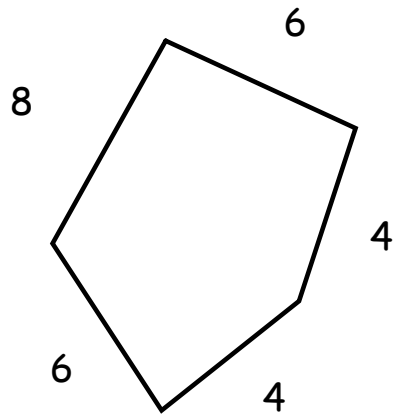
Similar?





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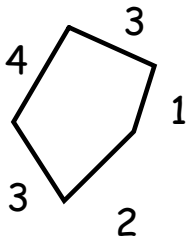
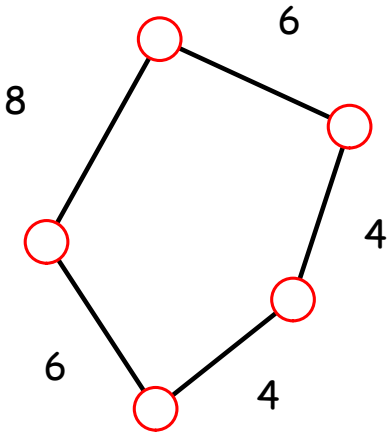
Similar?





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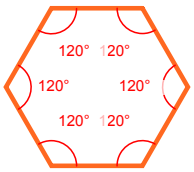
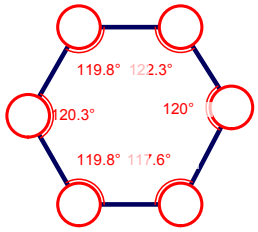
Finally, a similar polygon may have different length sides (as long as the *ratio* of corresponding sides is the same) but the *angles* will **remain the same!** If the angle(s) change, then the polygon is not similar!



Similar!



Not similar!

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